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MATHEMATICS PREPARATION 10

PROGRAM RATIONALE AND PHILOSOPHY

Rationale

Mathematics is a common human activity, increasing in importance in a rapidly advancing, technological society. A greater proficiency in using mathematics increases the opportunities available to individuals. Students need to become mathematically literate in order to explore problem-solving situations, accommodate changing conditions, and actively create new knowledge in striving for self-fulfillment.

A significant proportion of Grade 9 Mathematics students have marks that are close to, or slightly under, the pass mark of 50 per cent. These students are not sufficiently prepared to succeed in either Applied Mathematics 10 or Pure Mathematics 10 in senior high school. Nor does the alternative of Mathematics 14–24 address their needs. A senior high school mathematics course is needed to meet the needs of Grade 10 students who wish to enroll in either Applied Mathematics 10 or Pure Mathematics 10, but do not possess the prerequisite skills.

Students should not have to repeat outcomes for which they have already achieved an acceptable standard. Because of the sequential development of mathematical skills, some students will need to begin their programs with Grade 7 or Grade 8 outcomes. Others may only require preparation in the Grade 9 Mathematics outcomes. Two course delivery options allow for this flexibility. Schools can offer and students can choose either 3 or 5 credits for Mathematics Preparation 10 depending on the needs of the student.

Philosophy

A senior high school mathematics course that simply repeats the outcomes of Grade 9 Mathematics is not the optimal solution for Grade 10 students who have not met the standards of junior high mathematics. These students require a course that will address their individual needs with a focus on the mathematics skills and knowledge they lack from junior high school mathematics, or earlier. Students entering Grade 10 need a repertoire of fundamental mathematics skills and concepts. They also need to understand the ideas that make up those concepts and how they are related.

Students are required to demonstrate effective communication skills. When accomplishing program outcomes, students will be expected to explain, to illustrate, to reason and to make connections. Multiple solution strategies to problems and problem contexts will be expected as students work through routine and nonroutine problems.

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Technology is an integral part of this mathematics program. Calculators and computer programs are used to enhance conceptual understanding and to facilitate higher order thinking through exploration, modeling and problem solving.

Students learn by attaching meaning to what they do; and they must be able to construct their own meaning of mathematics. This meaning is best developed when learners encounter mathematical experiences that proceed from the simple to the complex and from the concrete to the abstract. The use of manipulatives can address the diversity of learning styles and developmental stages of students and can enhance the formation of sound, transferable, mathematical concepts. At all levels, students benefit from working with appropriate materials, tools and contexts when constructing personal meaning about new mathematical ideas. The learning environment should value and respect each student's way of thinking, so that the learner feels comfortable in taking intellectual risks, asking questions and posing conjectures.

Student Expectations

It is important for students to develop a positive attitude toward mathematics so they can become confident in their ability to use mathematics to solve real-life problems. Students should receive a level of mathematics education appropriate to their abilities and needs. At the completion of this program, students must have the mathematical knowledge, skills and attitudes needed to allow them to succeed in high school mathematics and become mathematically literate adults.

This program of studies incorporates the seven interrelated mathematical processes that are intended to permeate teaching and learning.

The students are expected to:

- *Communication [C]* – communicate mathematically
- *Connections [CN]* – connect mathematical ideas to other concepts in mathematics, to everyday experiences and to other disciplines
- *Estimation and Mental Mathematics [E]* – use estimation and mental mathematics where appropriate
- *Problem Solving [PS]* – relate and apply new mathematical knowledge through problem solving
- *Reasoning [R]* – reason and justify their thinking
- *Technology [T]* – select and use appropriate technologies as tools to solve problems
- *Visualization [V]* – use visualization to assist in processing information, making connections and solving problems.

For more details on these mathematical processes, please refer to the *Alberta Program of Studies for K–9 Mathematics*, June 1996, pages 6–11.

Instructional Focus

Students are curious, active learners who have individual interests, abilities and needs. They come to classrooms with different knowledge, life experiences and backgrounds that generate a range of attitudes about mathematics and life. Course delivery must be commensurate with differing abilities, interests and learning styles and be designed to enable students to have success in mathematics. The use of projects and technology should be emphasized to facilitate entrance into Applied Mathematics 10.

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Several additional considerations are important.

- The use of diagnostic strategies is encouraged to determine a student's area of strength and weakness. From this, individualized instruction should emerge.
- Concepts should be introduced, using manipulatives, and gradually developed from the concrete to the pictorial to the symbolic.
- Problem solving, reasoning and connections are vital to increasing mathematical power and must be integrated throughout the program. Activities that take place in the classroom should stem from a problem-solving approach with connections to the real world whenever possible. A minimum of half the available time within all strands could be dedicated to activities related to these processes.
- In mastering basic facts and arithmetic operations, the emphasis should be on developing understanding of the concept/processes, not on rote drill and practice. Although drill and practice needs to be part of a mathematics program, it should occur after students have developed an understanding of the concept/process and should not occur in isolation. If students understand the process, the amount of time needed for drill and practice is significantly reduced.
- There is to be a balance between estimation and mental mathematics, paper and pencil exercises and the appropriate use of technology, including calculators and computers.
- By decreasing emphasis on the size of numbers used in paper and pencil calculations, more time is available for concept development
- There is an assumption made that all students have regular access to appropriate technology. For Mathematics Preparation 10, the scientific calculator and standard spreadsheet programs are appropriate.

Student Outcomes

The content of the program of studies is stated in terms of outcomes. These outcomes are measurable and identify what students are required to know and be able to do. Mathematics Preparation 10 is made up of outcomes from the WCP framework that are judged to be essential for student success at the next level. The Mathematics Preparation 10 outcomes provide a foundation for Grade 10 mathematics courses.

Student expectations are described in terms of:

- **General Outcomes**: general statements that identify what students are expected to know and be able to do upon completion of a course.
- **Specific Outcomes:** statements identifying the component knowledge, skills and attitudes of a general outcome.
- **Illustrative Examples**: sample tasks that demonstrate and elaborate on the general and specific outcomes. They are important in conveying the richness, breadth and depth intended in the outcomes. The illustrative examples are for discretionary use.

Strands

The student outcomes are also organized within four strands:

- **Number**
- **Patterns and Relations**
- **Shape and Space**
- **Statistics and Probability**.

The strands are the formal aspects of the discipline of mathematics that form the foundation of the program of studies and act as connections across the grades. Four strands have been identified for the program of studies to reinforce the interrelationship of mathematical concepts and skills. These strands are split into substrands. However, any such grouping into strands and substrands is for organizational purpose only, and does not reflect the connections among the strands and the underlying themes running throughout all of mathematics.

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Horizontal Correlation

The General Outcomes from Mathematics Preparation 10 have been correlated to the corresponding General Outcomes in Grade 6 through Grade 10. These are shown in the chart below:

GENERAL OUTCOMES—Number Strand

Substrand	Grade 6	Grade 7	Grade 8
Number Concepts *Students will:* • use numbers to describe quantities • represent numbers in multiple ways.	Develop a number sense for decimals and common fractions, explore integers, and show number sense for whole numbers.	Demonstrate a number sense for decimals and integers, including whole numbers.	Demonstrate a number sense for rational numbers, including common fractions, integers and whole numbers.
Number Operations *Students will:* • demonstrate an understanding of and proficiency with calculations • decide which arithmetic operation or operations can be used to solve a problem and then solve the problem.	Apply arithmetic operations on whole numbers and decimals in solving problems.	Apply arithmetic operations on decimals and integers, and illustrate their use in solving problems. Illustrate the use of rates, ratios, percentages and decimals in solving problems.	Apply arithmetic operations on rational numbers to solve problems. Apply the concepts of rate, ratio, percentage and proportion to solve problems in meaningful contexts.

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Grade 9	*Mathematics Preparation 10*	Grade 10
Explain and illustrate the structure and the interrelationship of the sets of numbers within the rational number system. Develop a number sense of powers with integral exponents and rational bases.	*Demonstrate a knowledge of the interrelationships of the sets of numbers within the real number system.* *Develop a number sense of powers with integral exponents and rational bases.*	Analyze the numerical data in a table for trends, patterns and interrelationships. Explain and illustrate the structure and the interrelationship of the sets of numbers within the real number system.
Use a scientific calculator or a computer to solve problems involving rational numbers. Explain how exponents can be used to bring meaning to large and small numbers, and use calculators or computers to perform calculations involving these numbers.	*Decide which arithmetic operations can be used to solve problems and then solve the problem.* *Illustrate and apply the concepts of rates, ratios, percentages and proportion to solve problems.*	Use basic arithmetic operations on real numbers to solve problems. Describe and apply arithmetic operations on tables to solve problems, using technology as required. Use exact values, arithmetic operations and algebraic operations on real numbers to solve problems.

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GENERAL OUTCOMES—Patterns and Relations Strand

Substrand	Grade 6	Grade 7	Grade 8
Patterns *Students will:* • use patterns to describe the world and to solve problems.	Use relationships to summarize, generalize and extend patterns, including those found in music and art.	Express patterns, including those used in business and industry, in terms of variables, and use expressions containing variables to make predictions.	Use patterns, variables and expressions, together with their graphs, to solve problems.
Variables and Equations *Students will:* • represent algebraic expressions in multiple ways.	Use informal and concrete representations of equality and operations on equality to solve problems.	Use variables and equations to express, summarize and apply relationships as problem-solving tools in a restricted range of contexts.	Solve and verify one-step and two-step linear equations with rational number solutions.

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Grade 9	*Mathematics Preparation 10*	Grade 10
Generalize, design and justify mathematical procedures, using appropriate patterns, models and technology.	*Generalize, design and justify mathematical procedures, using appropriate patterns and technology.*	Generate and analyze number patterns.
Solve and verify linear equations and inequalities in one variable. Generalize arithmetic operations from the set of rational numbers to the set of polynomials.	*Solve and verify linear equations and inequalities using one variable.* *Generalize arithmetic operations from the set of rational numbers to the set of polynomials.*	Generalize operations on polynomials to include rational expressions.

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GENERAL OUTCOMES—Shape and Space Strand

Substrand	Grade 6	Grade 7	Grade 8
Measurement *Students will:* • describe and compare everyday phenomena, using either direct or indirect measurement.	Solve problems involving perimeter, area, surface area, volume and angle measurement.	Solve problems involving the properties of circles and their connections with angles and time zones.	Apply indirect measurement procedures to solve problems. Generalize measurement patterns and procedures, and solve problems involving area, perimeter, surface area and volume.
3-D Objects and 2-D Shapes *Students will:* • describe the characteristics of 3-D objects and 2-D shapes, and analyze the relationships among them.	Use visualization and symmetry to solve problems involving classification and sketching.	Link angle measures to the properties of parallel lines.	Link angle measures and the properties of parallel lines to the classification and properties of quadrilaterals.
Transformation *Students will:* • perform, analyze and create transformations.	Create patterns and designs that incorporate symmetry, tessellations, translations and reflections.	Create and analyze patterns and designs, using congruence, symmetry, translation, rotation and reflection.	Create and analyze design problems and architectural patterns, using the properties of scaling, proportion and networks.

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Grade 9	*Mathematics Preparation 10*	Grade 10
Use trigonometric ratios to solve problems involving a right triangle. Describe the effects of dimension changes in related 2-D shapes and 3-D objects in solving problems involving area, perimeter, surface area and volume.	*Solve problems using right angle triangles.* *Solve problems using perimeter, area, surface area and volume.*	Demonstrate an understanding of scale factors, and their interrelationship with the dimensions of similar shapes and objects. Solve problems involving triangles, including those found in 3-D and 2-D applications. Use measuring devices to make estimates and to perform calculations in solving problems.
Specify conditions under which triangles may be similar or congruent, and use these conditions to solve problems. Use spatial problem solving in building, describing and analyzing geometric shapes.	*Specify conditions under which triangles may be similar and use these conditions to solve problems.*	Solve coordinate geometry problems involving lines and line segments.
Apply coordinate geometry and pattern recognition to predict the effects of translations, rotations, reflections and dilatations on 1-D lines and 2-D shapes.	*Create and analyze patterns and design, using symmetry, translation, rotation and reflection.*	

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GENERAL OUTCOMES—Statistics and Probability Strand

Substrand	Grade 6	Grade 7	Grade 8
Data Analysis *Students will:* • collect, display and analyze data to make predictions about a population.	Develop and implement a plan for the collection, display and analysis of data gathered from appropriate samples.	Develop and implement a plan for the collection, display and analysis of data, using measures of variability and central tendency.	Develop and implement a plan for the collection, display and analysis of data, using technology, as required. Evaluate and use measures of central tendency and variability.

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Grade 9	*Mathematics Preparation 10*	Grade 10
Collect and analyze experimental results expressed in two variables, using technology, as required.	*Develop and implement a plan for the display and analysis of data.* *Analyze experimental results expressed in two variables.*	Implement and analyze sampling procedures, and draw appropriate inferences from the data collected. Apply line-fitting and correlation techniques to analyze experimental results.

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Coding of Outcomes for Mathematics Preparation 10

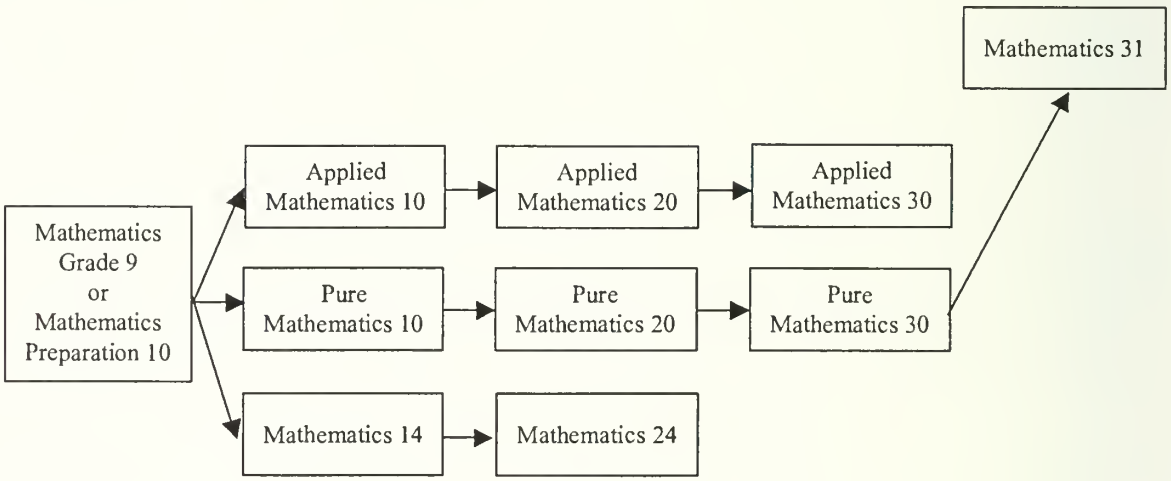
- The specific outcomes for Mathematics Preparation 10 have been numbered sequentially within each strand.
- Each specific outcome has been cross-referenced to the *Alberta Program of Studies for K–9 Mathematics*. For example, (8–7) refers to Grade 8, Specific Outcome 7, in the same strand as the stated outcome. This cross-referencing will allow teachers to refer to the *Alberta Program of Studies for K–9 Mathematics* for further illustrative examples of the Specific Outcomes.
- The mathematical processes to be addressed in conjunction with the specific outcomes are included after each outcome. For example, (C, V, R), means the students should use the mathematical processes of communication, visualization and reasoning in addressing this specific outcome.

Resources

There is no one specific resource for the Mathematics Preparation 10 course. Resources that are commonly found in Alberta schools have been identified for each outcome. Some of these resources are no longer authorized for current Alberta courses but may still be available in schools. Resource correlation will be updated in the next release of the program of studies.

High School Course Structure

Upon successful completion of Mathematics Preparation 10 a student may enroll in Applied Mathematics 10 or Pure Mathematics 10. A student who is not successful in Mathematics Preparation 10 may either repeat the course or enroll in Mathematics 14.



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Strand: Number (Number Concepts)

Students will:

- use numbers to describe quantities
- represent numbers in multiple ways.

C	Communication	**PS**	Problem Solving
CN	Connections	**R**	Reasoning
E	Estimation and Mental Mathematics	**T**	Technology
		V	Visualization

Outcomes	Illustrative Examples and Activities
General Outcome Demonstrate a knowledge of the interrelationship of the sets of numbers within the real number system. **Specific Outcome** 1. Compare and order integers. [R, V] (7–12)	1.1 Draw a number line from –10 to +10. Circle –8, –5 on the number line. Compare the integers using "greater than", "less than" and ">", "<". 1.2 Using a number line, write the integer (or integers) that is (are): • 4 greater than –3 • 2 less than 0 • between –3 and +2 • 2 units to the left of –1 • Is this number greater than or less than –1? • 3 units to the right of –1 • Is this number greater than or less than –1? 1.3 Arrange the following integers in ascending order: (–6, 7, –1, 0, 3, 5, –4)

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Outcomes	Illustrative Examples and Activities
General Outcome Demonstrate a knowledge of the interrelationship of the sets of numbers within the real number system. **Specific Outcome** 2. Find and be able to model an understanding of common multiples, common factors, lowest common multiples, greatest common factor as it applies to whole numbers. [C, PS, R, V] (6–4)	2.1 Have students use the "splitting into equal groups" model of division to work out the answers to the following questions. • $8 \div 2 = ?$ • $6 \div 2 = ?$ • $4 \div 2 = ?$ • $2 \div 2 = ?$ • $0 \div 2 = ?$ Have them discuss the last situation – 0 objects to split up with 2 in each group. Then have them consider $2 \div 0$ (2 objects split up with 0 in each group). Most students will see the question itself as being silly and that, therefore, there is no answer. • *Activity:* Building patterns on a number chart – Goal: To explore number concepts and their relationships, such as • primes and composites • multiples and factors • odd and even numbers • divisibility rules – Materials: Each student receives • a number chart 1 to 100 • colour pencils or markers (8 different colours)

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Outcomes	Illustrative Examples and Activities
	– Student instructions: 1. Place a **yellow** check mark on all multiples of 2. Look at the pattern and describe it. *(Possible student descriptions:* a) Alternate squares are filled. b) It looks like a checkerboard. c) Those are even numbers. They are multiples of 2.) 2. Continue by placing a **red** check mark on all multiples of 3. Look at the pattern and describe it. *(Possible student descriptions:* a) They are even and odd numbers. b) Some numbers have both red and yellow checks. c) Some numbers have two factors.) 3. Continue by placing a **blue** check on all multiples of 4. Look at the pattern and describe it. *(Possible student descriptions:* a) All are even. b) Some numbers have all 3 colours. c) Some numbers have 3 factors.) 4. Continue filling in the pattern in the following way: **white** – multiples of 5 **green** – multiples of 6 **orange** – multiples of 7 **black** – multiples of 8 *Reproduced with permission from Manitoba Education and Training.* 2.2 Three sisters, Janice, Jackie, and Gaye, live in 3 different cities. Janice returns home every 2 years, Jackie returns home every 3 years, and Gaye every 5 years. If the sisters were last reunited in 1990, what year will they get together next? *Reproduced with permission from Manitoba Education and Training.* 2.3 There were between 20 and 28 people at a party. The group could not be split into groups of 2, 3, 4, or 5 without leftovers. How many came? *Reproduced with permission from Manitoba Education and Training.*

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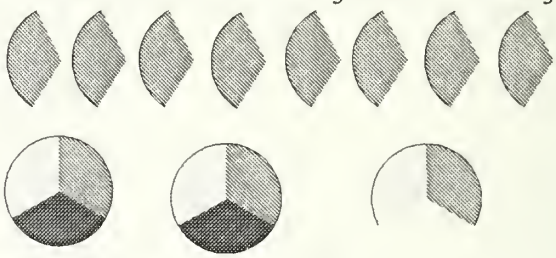
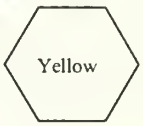
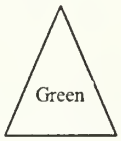
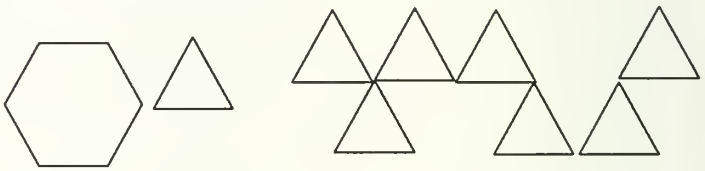
Outcomes	Illustrative Examples and Activities
General Outcome Demonstrate a knowledge of the interrelationship of the sets of numbers within the real number system. **Specific Outcome** 3. Demonstrate and explain the meaning of proper and improper fractions. [C, R, V] (6–9)	3.1 Use fraction circles to show that $\frac{8}{3}$ is equivalent to $2\frac{2}{3}$  3.2 Using pattern blocks, let  represent 1 whole. Then if  represents $\frac{1}{6}$ illustrate $1\frac{1}{6}$ as a mixed number and as an improper fraction.  $1\frac{1}{6}$ $\frac{7}{6}$

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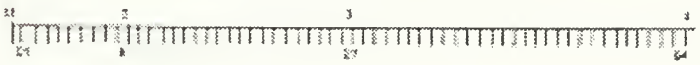
Outcomes	Illustrative Examples and Activities
General Outcome Demonstrate a knowledge of the interrelationship of the sets of numbers within the real number system. **Specific Outcome** 4. Distinguish between exact values and decimal approximations of square roots and cube roots. [E, T] (8–8)	4.1 Have students use known squares to estimate square roots. Say: "Make a number line such as the following": "To estimate the square root of 28, find it on the number line and decide where it is in relation to the nearest squares and corresponding square roots. For example, $\sqrt{28}$ is less than 5.5 and approximately equal to 5.3." 4.2 Have students use known cubes to estimate cube roots: 

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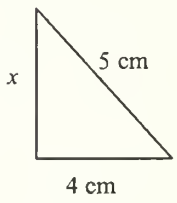
Outcomes	Illustrative Examples and Activities
General Outcome Demonstrate a knowledge of the interrelationship of the sets of numbers within the real number system. **Specific Outcome** 5. Differentiate between principal square root and positive and negative square roots of a number. Give examples where answers would involve the positive (principal) square root, or both positive and negative square roots of a number. [C, CN, PS, R] (9–3)	5.1 Use a calculator to find the value of the following. a) $\sqrt{324}$ b) $-\sqrt{5}$ *Answers* a) 18 b) –2.24 Find both the positive and negative square roots ***Examples*** Solve for x. a) $x^2 = 16$ *Answer* $x = \pm 4$ b) 

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Outcomes	Illustrative Examples and Activities

Answer

$x^2 + (4)^2 = (5)^2$

$x^2 + 16 = 25$

$x^2 = 25 - 16$

$x^2 = 9$

$x = \pm 3$

In many practical situations only the principal square root is the solution. Therefore, the solution is 3 cm.

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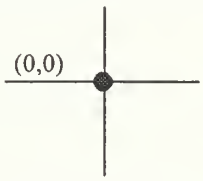
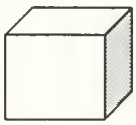
5.2 If you wanted to find the length of 1 side of a square garden whose area is 25 m^2, explain why you would use only the positive square root of 25.

5.3 A square has 1 vertex at (0, 0) and an area of 25 square units. Find the coordinates of the other vertices for at least 4 such squares.



As an extension, find a fifth square.

5.4 If the length of a diagonal of a dice of a cube is 4, what is the volume of the cube?



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Outcomes	Illustrative Examples and Activities
General Outcome Develop a number sense of powers with integral exponents and rational bases. **Specific Outcome** 6. Recognize and illustrate the meaning of a power, base, coefficient and exponent, including rational numbers or variables as bases or coefficients. [R, V] (9–4)	6.1 In the following expressions identify the coefficient, base and exponent: • -2^3 • x^{-4} • $-3(xy)^5$ • $\frac{x}{5}$ • 2 • $-\frac{3}{4}xy^7$ 6.2 Write the following in expanded form: • 3^5 • t^3 • -2^4 • $(-2)^4$ • x^{-4}

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Outcomes	Illustrative Examples and Activities
General Outcome Develop a number sense of powers with integral exponents and rational bases. **Specific Outcome** 7. Explain and apply the exponent laws for powers with integral exponents. $x^m \bullet x^n = x^{m+n}$ $x^m \div x^n = x^{m-n}$ $(x^m)^n = x^{mn}$ $(xy)^m = x^m y^m$ $\left(\frac{x}{y}\right)^n = \frac{x^n}{y^n}, y \neq 0$ $x^0 = 1, x \neq 0$ $x^{-n} = \frac{1}{x^n}, x \neq 0$ [PS, R] (9–5)	7.1 Write equivalent expressions with positive exponents. a) $\frac{x^{-2}}{y}$ b) $\frac{x^2}{y^{-3}}$ c) $\frac{x^{-2}y}{z^{-6}}$ d) $\frac{-2x^{-2}}{y^{-4}}$ *Reproduced with permission from Manitoba Education and Training.* 7.2 Express $2^{-1} + 4^{-1}$ as the sum of 2 rational numbers. 7.3 Using a variety of operations, write expressions that are equivalent to x^2. Use your imagination. *Reproduced with permission from Manitoba Education and Training.* 7.4 Evaluate. a) 3^{-2} b) -3^{-2} c) $(-3)^{-2}$ d) $\frac{2^{-2}}{3}$ e) $\frac{1}{2^{-3}}$

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		V	Visualization

Outcomes	Illustrative Examples and Activities
	7.5 Simplify removing negative exponents and parentheses. a) $\left(\frac{2}{3}\right)^{-5}$ b) $\left(35^2\right)^3$ c) $(xy)^n$ d) $\left(\frac{x}{y}\right)^n$ e) $\left(\frac{x}{y}\right)^{-n}$ 7.6 The quantities in bold type may contain errors. By correctly applying the exponent laws, replace incorrect answers with correct answers. a) $m^4 \bullet m^3 = m^{12}$ b) $m^{12} \div m^2 = m^6$ c) $\left(m^5\right)^2 = m^7$ d) $(xy)^6 = x^1 y^6$ e) $\left(\frac{x}{y}\right)^3 = \left(\frac{x^3}{y^1}\right)$ f) $\left(\frac{2^3}{3}\right) = \left(\frac{2^3}{3^3}\right)$ g) $3^0 = 0$ h) $5^1 = 1$ *Reproduced with permission from British Columbia Ministries.* 7.7 Explain why $5^0 = 1$ not zero.

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Strand: Number (Number Operations)

Students will:

- demonstrate an understanding of and proficiency with calculations
- decide which arithmetic operation or operations can be used to solve a problem and then solve the problem.

C	Communication	**PS**	Problem Solving
CN	Connections	**R**	Reasoning
E	Estimation and Mental Mathematics	**T**	Technology
		V	Visualization

Outcomes	Illustrative Examples and Activities
General Outcome Use a scientific calculator to solve problems involving real numbers. **Specific Outcome** 8. Document and explain the calculator keying sequences used to perform: • square roots, cube roots • exponents • scientific notation • sine, cosine, tangent • integers. [PS, R, T] (9–10)	

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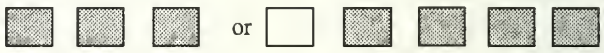
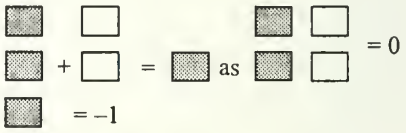
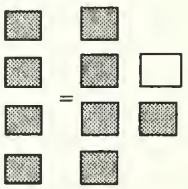
CN	Connections	R	Reasoning
E	Estimation and Mental Mathematics	T	Technology
		V	Visualization

Outcomes	Illustrative Examples and Activities
General Outcome Demonstrate an understanding of and proficiency with calculations on rational numbers. Decide which arithmetic operations can be used to solve problems and then solve the problem. **Specific Outcome** 9. Perform arithmetic operations with integers concretely, pictorially and symbolically. [PS, V] (7–16)	9.1 Using algebra tiles, express the number 3 in as many ways as possible. e.g.  or 9.2 Use tiles to calculate the following: • $(+3)+(-2)$ solution  = 0 • $(+4)-(-1)$ solution  Now subtract –1; you are left with 5.

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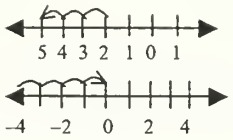
C	Communication	**PS**	Problem Solving
CN	Connections	**R**	Reasoning
E	Estimation and Mental Mathematics	**T**	Technology
		V	Visualization

Outcomes	Illustrative Examples and Activities

9.3 Using the number line:

a) subtract 3 from –2

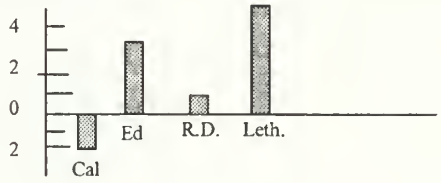
b) add (+4) to (–4)



9.4 Simplify the following:

a) $(-4) - (-6)$
b) $(-12 \div (-4)$
c) $(-7)(+2)$
d) $-4 + 1$
e) $-2 - 3$
f) $3 - 5$

9.5 The following graph shows the temperature in 4 Alberta cities at 7:00 A.M. on May 24th.



How much warmer is Edmonton than Calgary, Lethbridge than Edmonton?
How much colder is Calgary than Red Deer?

9.6 Calculate

a) $(-1) + (-3) - (+2)$
b) $-3 - 6 + 5$
c) $\frac{(-3)(-6)}{2}$

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Strand: Number (Number Operations)

Students will:

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C	Communication	**PS**	Problem Solving
CN	Connections	**R**	Reasoning
E	Estimation and Mental Mathematics	**T**	Technology
		V	Visualization

Outcomes	Illustrative Examples and Activities
General Outcomes Demonstrate an understanding of and proficiency with calculations on rational numbers. Decide which arithmetic operations can be used to solve problems and then solve the problem. **Specific Outcome** 10. Illustrate and explain the order of operations. [PS, T, V] (7–17)	10.1 Determine the missing operation signs so that the following statement is true (9.4 ☐ 4.7) ☐ 2 = 9.4 Using 5 5 5 5 and using brackets, addition, subtraction, multiplication or division try to make the expression equal to as many numbers as you can between 0 and 20. e.g. (5 + 5) – (5 + 5) = 0 e.g. 5 + (5 ÷ 5) – 5 = 1

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Strand: Number (Number Operations)

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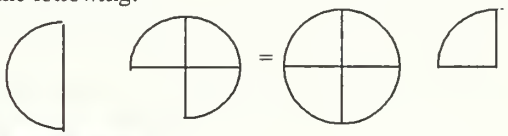
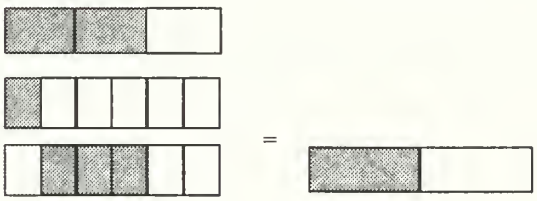
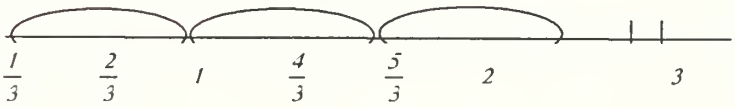
C	Communication	**PS**	Problem Solving
CN	Connections	**R**	Reasoning
E	Estimation and Mental Mathematics	**T**	Technology
		V	Visualization

Outcomes	Illustrative Examples and Activities
General Outcomes Demonstrate an understanding of and proficiency with calculations on rational numbers. Decide which arithmetic operations can be used to solve problems and then solve the problem. **Specific Outcome** 11. Add, subtract, multiply and divide fractions concretely, pictorially and symbolically. [E, PS, V] (8–9)	11.1 Use pattern blocks, fraction strips, number lines or paper folding to evaluate the following: • $\frac{1}{2}+\frac{3}{4}$  • $\frac{2}{3}-\frac{1}{6}$  • $3\times\frac{2}{3}$ 

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Strand: Number (Number Operations)

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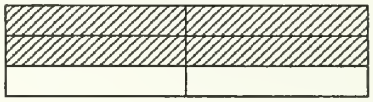
C	Communication	**PS**	Problem Solving
CN	Connections	**R**	Reasoning
E	Estimation and Mental Mathematics	**T**	Technology
		V	Visualization

Outcomes	Illustrative Examples and Activities

- $\frac{2}{3} \times \frac{1}{2}$  $= \frac{2}{3}$

- $\frac{3}{4} \div \frac{1}{8}$

$\frac{1}{4}$		$\frac{1}{4}$		$\frac{1}{4}$		$\frac{1}{4}$	
$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{8}$

$= 6$

11.2 Joe had $\frac{3}{4}$ of a bottle of pop. He drank $\frac{2}{3}$ of the pop in the bottle. How much pop was left in the bottle?

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Strand: Number (Number Operations)

Students will:

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- decide which arithmetic operation or operations can be used to solve a problem and then solve the problem.

C	Communication	**PS**	Problem Solving
CN	Connections	**R**	Reasoning
E	Estimation and Mental Mathematics	**T**	Technology
		V	Visualization

Outcomes	Illustrative Examples and Activities
General Outcomes Demonstrate an understanding of and proficiency with calculations on rational numbers. Decide which arithmetic operations can be used to solve problems and then solve the problem. **Specific Outcome** 12. Convert among fractions, decimals and percents to problem solve. [E, PS, T, R] (8–12)	12.1 Student Council organized an activity day. The choice of activities was going to a water slide or going to IMAX Theatre, a) If $\frac{3}{4}$ of the student population went to the water slide, what percent of the students attended the IMAX Theatre. b) If there are 2000 students taking part in activity day, how many attended each activity? 12.2 A pair of jeans retails for $70. If the jeans are on sale for 30% off the regular price, what is the cost of the jeans (excluding taxes)?

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Strand: Number (Number Operations)

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C	Communication	**PS**	Problem Solving
CN	Connections	**R**	Reasoning
E	Estimation and Mental Mathematics	**T**	Technology
		V	Visualization

Outcomes	Illustrative Examples and Activities
General Outcomes Demonstrate an understanding of and proficiency with calculations on rational numbers. Decide which arithmetic operations can be used to solve problems and then solve the problem. **Specific Outcome** 13. Estimate and calculate operations, on rational numbers. [E, PS, T] (8–10)	13.1 George has a balance of $100.83 in his bank account. He has an overdraft protection of $50. He wrote a cheque for $148.50 for a used snowboard. Then he deposits $60 from babysitting revenue. He withdraws $30 for a present for Mother's Day. What is the final balance at the end of these transactions? 13.2 At a soccer party at the end of the season, the coach decides to buy pizza for everyone. He orders 5 large pizzas; three Hawaiian and 2 Pepperoni. If $\frac{1}{8}$ of the pepperoni pizza and $\frac{1}{6}$ of the Hawaiian are left, what fraction of the total amount of pizza was eaten?

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Strand: Number (Number Operations)

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C	Communication	**PS**	Problem Solving
CN	Connections	**R**	Reasoning
E	Estimation and Mental Mathematics	**T**	Technology
		V	Visualization

Outcomes	Illustrative Examples and Activities
General Outcomes Demonstrate an understanding of and proficiency with calculations on rational numbers. Decide which arithmetic operations can be used to solve problems and then solve the problem. **Specific Outcome** 14. Solve problems involving multiple steps and multiple operations, and accept that other methods may be equally valid. [PS] (5–13)	14.1 Write an expression, then simplify: a) Multiply the sum of –35 and 42 by –4 b) Subtract –16 from + 18, then divide by 4 c) Add the product of –7 and –24 to + 52 d) Divide + 81 by the product of –3 and + 3 e) Subtract the sum of –42 and –9 from the product of –17 and + 5. 14.2 Meadowview High put on a school dance. The admission charge was $6.50 per person. The cost of the DJ was $750.00 and the cost of decorating the hall was $200.00. If 180 people attended the dance, what was the profit?

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C	Communication	**PS**	Problem Solving
CN	Connections	**R**	Reasoning
E	Estimation and Mental Mathematics	**T**	Technology
		V	Visualization

Outcomes	Illustrative Examples and Activities
General Outcomes Demonstrate an understanding of and proficiency with calculations on rational numbers. Decide which arithmetic operations can be used to solve problems and then solve the problem. **Specific Outcome** 15. Use a variety of methods to solve problems, such as drawing a diagram, making a table, guessing and testing, using objects to model, making it simpler, looking for a pattern, using logical reasoning and working backward. [PS, R, T, V] (6–14)	15.1 The following figures were made with toothpicks that are 6 cm long. 6 cm 6 cm 6 cm a) Look at the pattern formed by the toothpick figures. How are the figures the same? How are they different? b) Sketch/create the next three figures in the pattern. c) Calculate the perimeter of each figure and use this information to complete the table below: d) Graph the data from (c) using number of sides for the horizontal axis and perimeter for the vertical axis. Describe the pattern in the table and the graph. e) Suppose this pattern continues. What is the perimeter of the polygon with 75 sides.

# of sides	1	2	3	4	5	6	7	8
perimeter								

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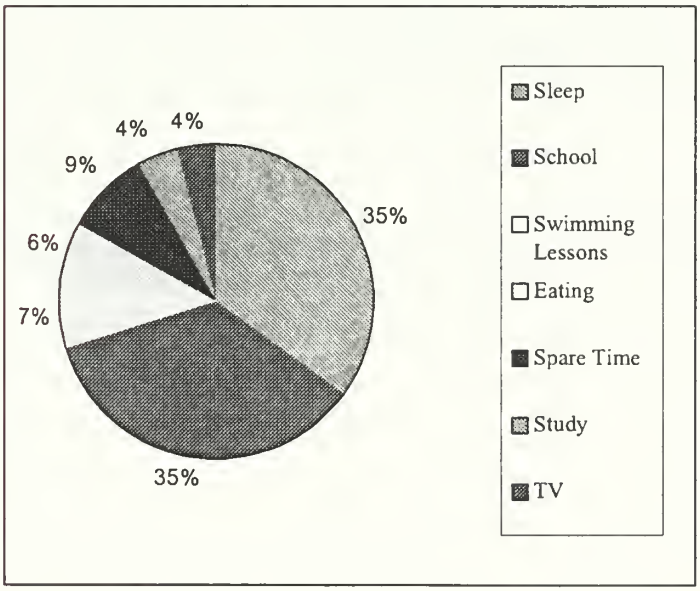
C	Communication	**PS**	Problem Solving
CN	Connections	**R**	Reasoning
E	Estimation and Mental Mathematics	**T**	Technology
		V	Visualization

Outcomes	Illustrative Examples and Activities
General Outcome Illustrate and apply the concepts of rates, ratios, percentages and proportion to solve problems. **Specific Outcome** 16. Understand the meaning of rate, ratio, percentages and proportion and apply these concepts to solve problems. [E, PS, T] (8–12)	16.1 A typical student's day. How many hours per day are spent for each of these activities? Round to the nearest tenth.  16.2 A store has a NO GST sale. Darcy purchased a skirt priced at $39.99. When she paid for it, the clerk first subtracted 7% to get a new price and then added 7% GST to this new price. Is this a fair way to calculate the price? Why would a store use this practice? 16.3 In Canada, there are 1 million curlers registered in 1 200 clubs. In Scotland, there are 50 000 curlers in 52 clubs, and in Sweden there are 9 000 curlers in 36 clubs. Write a ratio for each to compare the numbers of curlers to the number of clubs, and arrange these in order of size from least to greatest.

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Strand: Number (Number Operations)

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CN	Connections	**R**	Reasoning
E	Estimation and Mental Mathematics	**T**	Technology
		V	Visualization

Outcomes	Illustrative Examples and Activities
General Outcome Illustrate and apply the concepts of rates, ratios, percentages and proportion to solve problems. **Specific Outcome** 16. Understand the meaning of rate, ratio, percentages and proportion and apply these concepts to solve problems. [E, PS, T] (8–12)	16.4 A class of 25 students has an average mark of 65% on a written test, a second class of 21 students has an average of 60%, and a third class of 23 has an average of 67%. Find the average mark for all of the students.

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CN	Connections	**R**	Reasoning
E	Estimation and Mental Mathematics	**T**	Technology
		V	Visualization

Outcomes	Illustrative Examples and Activities
General Outcome Illustrate and apply the concepts of rates, ratios, percentages and proportion to solve problems. **Specific Outcome** 17. Express rates and ratios in equivalent forms. [CN, PS, R] (8–15)	17.1 When you say that the bus from Edmonton to Calgary travelled a distance of 264 km in 3 hours, you are comparing the of distance travelled to the of time required. a) Write the speed of the bus as a rate. b) How far does the bus travel in 1 hour? c) If it is 156 km from Edmonton to Red Deer, how long does it take the bus to travel from Edmonton to Red Deer? *Reproduced with permission from Alberta Distance Learning.* 17.2 The body of an adult contains about 5 L of blood. A blood donor gives 450 mL of blood. What is the ratio of the amount of donated blood to the total amount of blood in the body? *Reproduced with permission from Alberta Distance Learning.*

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C	Communication	PS	Problem Solving
CN	Connections	R	Reasoning
E	Estimation and Mental Mathematics	T	Technology
		V	Visualization

Outcomes	Illustrative Examples and Activities
General Outcome Apply exponent laws to solve problems. **Specific Outcome** 18. Use exponent laws to evaluate expressions with numerical bases. [PS, R, T]	18.1 By correctly applying the exponent laws to evaluate expressions, replace any incorrect value in bold type with the correct values. $\frac{2^{1000}}{2^{500}} = \mathbf{2^2}$ $\quad 3^7 \bullet 3^8 = \mathbf{9^{15}}$ $\quad -5^2 = \mathbf{25}$ $(2^3)^2 = \mathbf{4^6}$ *Reproduced with permission from British Columbia Ministry of Education.*

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Strand: Number (Number Operations)

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C	Communication	PS	Problem Solving
CN	Connections	R	Reasoning
E	Estimation and Mental Mathematics	T	Technology
		V	Visualization

Outcomes	Illustrative Examples and Activities
General Outcome Apply exponent laws to solve problems. **Specific Outcome** 19. Understand and use the exponent laws to simplify expressions with variables as bases and use substitution to calculate a numerical value. [PS, R, T] (9–9)	19.1 Accident investigators use the friction of the road to calculate the speed of the vehicles in an accident using the formula: $F = \frac{v^2}{273S}$ when F = friction of the road (N) v= velocity of car (km/h) S = skid length of the car (m) a) Use this formula to complete the following table: **Variable** **Base** **Coefficient** **Exponent** F V S b) Rewrite the formula with V on its own. c) If the speed of the car is 80 km/h, and the skid length is 11 m, find the friction of the road. *Reproduced with permission from British Columbia Ministry of Education.* 19.2 The surface of a sphere is given by the formula $4\pi r^2$ and the volume is given by $\frac{4}{3}\pi r^3$. a) Indicate those parts of the expression that represent coefficients, powers, bases and exponents. b) Find the volume and surface area if the radius is a) 2, b) $\frac{3}{2}$. *Reproduced with permission from British Columbia Ministry of Education.* 19.3 A sphere fits exactly into a cubical box with the length of each side = L. a) What is the radius of the sphere in terms of L? b) What is the volume and area of the sphere in terms of L?

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CN	Connections	**R**	Reasoning
E	Estimation and Mental Mathematics	**T**	Technology
		V	Visualization

Outcomes	Illustrative Examples and Activities
	19.4 If you use a calculator to solve the expression $\frac{7.2\times10^{80}}{3.5\times10^{-34}}$ the calculator provides an error message. Why? Use the exponent laws to evaluate this expression.

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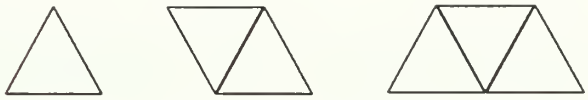
Strand: Patterns and Relations (Patterns)

Students will:

- use patterns to describe the world and to solve problems.

C	Communication	**PS**	Problem Solving
CN	Connections	**R**	Reasoning
E	Estimation and Mental Mathematics	**T**	Technology
		V	Visualization

Outcomes	Illustrative Examples and Activities
General Outcome Generalize, design and justify mathematical procedures, using appropriate patterns and technology. **Specific Outcome** 1. Generalize a pattern arising from a problem solving context using mathematical expressions and equations, and verify by substitution. [C, CN, PS, R] (8–1, 9–1)	1.1  a) Describe the pattern in the figures above. Draw the next 4 figures in this pattern. b) Find the perimeter of each figure assuming 1 side of a triangle represents 1 unit you draw. Copy and complete this table. c) Suppose this pattern continues. What is the perimeter of the figure with 15 triangles? d) What is the perimeter of the figure with 40 triangles? e) Write an expression to describe the relationships. f) Verify your expression using numbers of triangles = 1, 2, 3.

Number of Triangles	1	2	3
Perimeter			

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Strand: Patterns and Relations (Patterns)
Students will:
- use patterns to describe the world and to solve problems.

C	Communication	PS	Problem Solving
CN	Connections	R	Reasoning
E	Estimation and Mental Mathematics	T	Technology
		V	Visualization

Outcomes	Illustrative Examples and Activities
General Outcome Generalize, design and justify mathematical procedures, using appropriate patterns and technology. **Specific Outcome** 2. Given a first degree equation, substitute numbers for variables and graph and analyze the relation. [C, PS, R, V] (8–2)	2.1 A local drive-in theatre charges a flat fee of $5.00 per vehicle and an additional cost of $1.50 per person. The cost of going to the drive-in theatre is represented by the equation $C = 1.5p + 5$. a) Complete the table. b) Graph the relationship.

p	1	2	3	4	5	6
c						

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Students will:

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C	Communication	PS	Problem Solving
CN	Connections	R	Reasoning
E	Estimation and Mental Mathematics	T	Technology
		V	Visualization

Outcomes	Illustrative Examples and Activities
General Outcome Generalize, design and justify mathematical procedures, using appropriate patterns and technology. **Specific Outcome** 3. Translate between an oral or written expression and an equivalent algebraic expression. [C, CN] (8–3, 9–8)	3.1 At the ocean's surface, seawater exerts a pressure of 100 kPa. For every 2 m of depth that an object submerges, the pressure increases by 15 kPa. If Sierra is wearing a watch that is guaranteed to survive 200 kPa, to what depth is the watch guaranteed? Write an algebraic equation that could be used to solve this problem. *Adapted with permission from Manitoba Education and Training.* 3.2 $\frac{b}{12} = 4$ State what b represents and write a story problem that can be solved with the above equation. *Reproduced with permission from Manitoba Education and Training.*

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Strand: Patterns and Relations (Patterns)
Students will:
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C	Communication	**PS**	Problem Solving
CN	Connections	**R**	Reasoning
E	Estimation and Mental Mathematics	**T**	Technology
		V	Visualization

Outcomes	Illustrative Examples and Activities
General Outcome Generalize, design and justify mathematical procedures, using appropriate patterns and technology. **Specific Outcome** 4. Write equivalent forms of algebraic expressions, or equations, with integral coefficients. [C, CN, R] (9–3)	4.1 Rewrite the following formula to solve for w: $v = lwh$. 4.2 Rearrange this expression as many ways as possible so it remains equivalent to the original. $5x - 3y + z - 2$ 4.3 Write 4 different equivalent expressions for $2x + 6$. Possible answers: a) $2x + 6 = 2x + 11 - 5$ b) $2x + 6 = x + 5 + x + 1$ c) $2x + 6 = 5x - 3 - 3x + 9$ d) $2x + 6 = 2(x + 3)$ 4.4 *Examples* a) Is $2x = x + 2$? Explain. b) is $-(x - 3)$ the same as $3 - x$? c) Are $2(1 - x)$ and $-2(x - 1)$ equivalent expressions? d) Which of the following expressions are equivalent to $\frac{x+3}{2}$? Justify your choice. $x + 3 \div 2$; $\frac{x}{2} + \frac{3}{2}$; $2(x + 3)$; $(x + 3) \div 2$

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Strand: Patterns and Relations (Variables and Equations)

Students will:

- represent algebraic expressions in multiple ways.

C	Communication	**PS**	Problem Solving
CN	Connections	**R**	Reasoning
E	Estimation and Mental Mathematics	**T**	Technology
		V	Visualization

Outcomes	Illustrative Examples and Activities
General Outcome Generalize arithmetic operations from the set of rational numbers to the set of polynomials. **Specific Outcome** 5. Identify constant terms, coefficients and variables in polynomial expressions. [C] (9–7)	5.1 a) What is the constant term in the expression $4x + 2y - 8$? b) What is the coefficient of $4 - 8a^2b^5$? c) Write a trinomial involving 2 variables, having coefficients of 6 and –3, and a constant term of 2. *Adapted with permission from Manitoba Education and Training.*

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Strand: Patterns and Relations (Variables and Equations)

Students will:

- represent algebraic expressions in multiple ways.

C	Communication	**PS**	Problem Solving
CN	Connections	**R**	Reasoning
E	Estimation and Mental Mathematics	**T**	Technology
		V	Visualization

Outcomes	Illustrative Examples and Activities
General Outcome Generalize arithmetic operations from the set of rational numbers to the set of polynomials. **Specific Outcome** 6. Evaluate polynomial expressions, given the values of the variables. [E] (9–8)	6.1 Find the value of: a) $3x - 5y$ where $x = 6$ and $y = 2$ b) $-x^2 + 5x + 3$ where $x = -3$ c) $2m^2 + 5m$ where $m = 2$ 6.2 The Acme Car Shop charges its customers according to the formula $C = 45 + 35.60h$, whereas the Classic Car Repair Shop uses the formula $C = 30 + 41.70h$. For both formulas, C is the repair cost in dollars and h is the number of hours of repair work. a) Nancy has 5 hours of repair work to be done to her car. How much less would she pay by taking her car to the cheaper shop? b) Bill paid \$169.60 for repair work at the Acme Car Shop. How many hours of repair work was he charged for? *Reproduced with permission of Manitoba Education and Training.* 6.3 For each of the following expressions, determine which expression gives the least value when $x = 3$ and when $x = -3$. $2x, x+2, \frac{x}{2}, x-2, 2+x, 2-x$ *Reproduced with permission from Manitoba Education and Training.*

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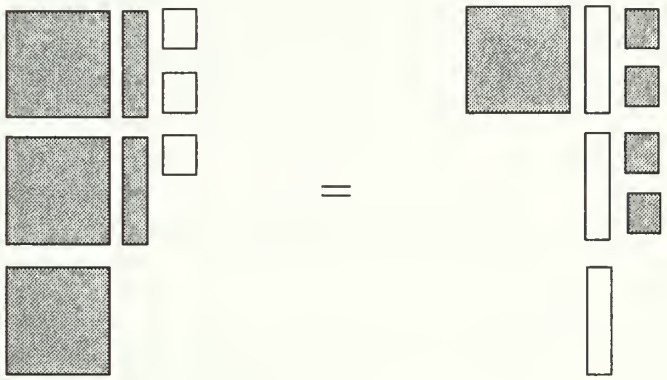
Strand: Patterns and Relations (Variables and Equations)

Students will:

- represent algebraic expressions in multiple ways.

C	Communication	PS	Problem Solving
CN	Connections	R	Reasoning
E	Estimation and Mental Mathematics	T	Technology
		V	Visualization

Outcomes	Illustrative Examples and Activities
General Outcome Generalize arithmetic operations from the set of rational numbers to the set of polynomials. **Specific Outcome** 7. Represent and justify the addition and subtraction of polynomial expressions, using concrete materials and diagrams. [C, R, V] (9–9)	7.1 Explain how algebra tiles can be used to illustrate the algebraic process for simplifying the following: $(2x^2 + 3x + 2) + (x^2 - 5x - 1)$ $(4x^2 - 2x - 3) - 2x^2 - 5x)$ 7.2 Simplify the algebraic expression that is represented by the following diagram.  7.3 Use algebra tiles to explain why $(\Delta + \square)^2 \neq \Delta^2 + \square^2$

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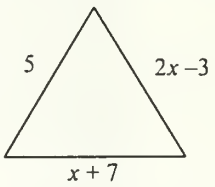
Strand: Patterns and Relations (Variables and Equations)

Students will:

- represent algebraic expressions in multiple ways.

C	Communication	PS	Problem Solving
CN	Connections	R	Reasoning
E	Estimation and Mental Mathematics	T	Technology
		V	Visualization

Outcomes	Illustrative Examples and Activities
General Outcome Generalize arithmetic operations from the set of rational numbers to the set of polynomials. **Specific Outcome** 8. Perform the operations of addition and subtraction on polynomial expressions. [R] (9–10)	8.1 Simplify a) $5x - 7x + 2x$ b) $-5xy + 3xy$ c) $(3x - 8) - (x^2 + 5x - 6)$ d) $(5x^3 + 3m + 2) + (-2x^3 + 5p - 6)$ e) Subtract $(-2x^2 + 5x - 3)$ from $(5x^2 - 3x^7)$ 8.2 Write a simplified expression for the perimeter of the triangle below.  *Adapted with permission for Manitoba Education and Training.* 8.3 The perimeter of a quadrilateral is $(10x + 4y + 16)$. What is a possible expression for the length of each side? *Adapted with permission from Manitoba Education and Training.*

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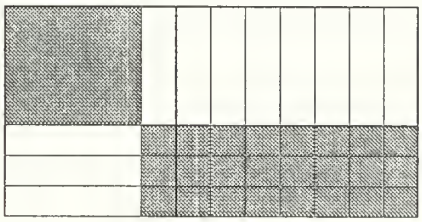
Strand: Patterns and Relations (Variables and Equations)

Students will:

- represent algebraic expressions in multiple ways.

C	Communication	PS	Problem Solving
CN	Connections	R	Reasoning
E	Estimation and Mental Mathematics	T	Technology
		V	Visualization

Outcomes	Illustrative Examples and Activities
General Outcome Generalize arithmetic operations from the set of rational numbers to the set of polynomials. **Specific Outcome** 9. Represent multiplication, division and factoring of monomials, binomials and trinomials of the form $x^2 + bx + c$ using concrete materials and diagrams. (R, V) [9–11]	9.1 Use algebra tiles to represent each of the following products. a) $2x\,(x + 3)$ b) $3\,(2x + 1)$ c) $(x + 2)\,(2x + 1)$ d) $(2x + 1)\,(x - 1)$ 9.2 Use algebra tiles to represent the factoring of the following polynomials. a) $6x + 9$ b) $2x^2 + 6x$ c) $x^2 + 8x + 12$ d) $x^2 - 5x + 6$ 9.3 Use algebra tiles to represent the following division. $(6x^2 + 8x) \div (2x)$ 9.4 What are the factors of the polynomial represented by the tiles below? 

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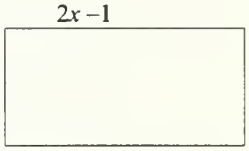
Strand: Patterns and Relations (Variables and Equations)

Students will:

- represent algebraic expressions in multiple ways.

C	Communication	**PS**	Problem Solving
CN	Connections	**R**	Reasoning
E	Estimation and Mental Mathematics	**T**	Technology
		V	Visualization

Outcomes	Illustrative Examples and Activities
General Outcome Generalize arithmetic operations from the set of rational numbers to the set of polynomials. **Specific Outcome** 10. Find the product of: • two monomials • a monomial and a polynomial • two binomials. [R] (9–12)	10.1 Find each product. a) $-2m^2\,(3m^3)$ b) $3m\,(2m + 6)$ c) $(3x - 7)\,(2x + 5)$ d) $(2x - 9)^2$ e) $3x\,(2x^2 + 5x - 8)$ f) $7\,(8x - 2y) - 4\,(6x + 3y)$ g) $(3x - 2)\,(3x + 2)$ 10.2 Express the area of the rectangle in terms of x. $2x - 1$ $x + 3$ 

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Strand: Patterns and Relations (Variables and Equations)

Students will:

- represent algebraic expressions in multiple ways.

C	Communication	**PS**	Problem Solving
CN	Connections	**R**	Reasoning
E	Estimation and Mental Mathematics	**T**	Technology
		V	Visualization

Outcomes	Illustrative Examples and Activities
General Outcome Generalize arithmetic operations from the set of rational numbers to the set of polynomials. **Specific Outcome** 11. Determine equivalent forms of algebraic expressions by identifying common factors. [PS, R] (9–13)	11.1 For each of the following, identify the common factor and complete the factorization. a) $14x^3 - 7x^2 + 28x$ b) $4m^2 - 12m$ c) $m^6 - m^5 + m^4$ d) $3x(x-2) + 4(x-2)$ e) $2\pi r^2 + 2\pi rh$

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Strand: Patterns and Relations (Variables and Equations)

Students will:

- represent algebraic expressions in multiple ways.

C	Communication	PS	Problem Solving
CN	Connections	R	Reasoning
E	Estimation and Mental Mathematics	T	Technology
		V	Visualization

Outcomes	Illustrative Examples and Activities
General Outcome Generalize arithmetic operations from the set of rational numbers to the set of polynomials. **Specific Outcome** 12. Factor trinomials of the form $ax^2 + bx + c$ where $a = 1$, or of the form $ax^2 + abx + ac$. [PS, R] (9–13)	12.1 Factor the following trinomials. a) $m^2 + 12m + 11$ b) $m^2 - 4m - 12$ c) $m^2 - 4m - 12$ d) $2m^2 + 20m + 50$ e) $3m^3 - 12m + 12$ 12.2 A rectangle has an area of $m^2 + 12m + 20$. Determine expressions for its length and width.

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Strand: Patterns and Relations (Variables and Equations)

Students will:

- represent algebraic expressions in multiple ways.

C	Communication	PS	Problem Solving
CN	Connections	R	Reasoning
E	Estimation and Mental Mathematics	T	Technology
		V	Visualization

Outcomes	Illustrative Examples and Activities
General Outcome Generalize arithmetic operations from the set of rational numbers to the set of polynomials. **Specific Outcome** 13. Factor polynomials of the form $A^2 - B^2$ where A and B are both monomial expressions. [PS, R]	13.1 Factor the following polynomials. a) $m^2 - 9$ b) $9m^2 - 25$ c) $16x^2 - 49y^2$

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Strand: Patterns and Relations (Variables and Equations)

Students will:

- represent algebraic expressions in multiple ways.

C	Communication	PS	Problem Solving
CN	Connections	R	Reasoning
E	Estimation and Mental Mathematics	T	Technology
		V	Visualization

Outcomes	Illustrative Examples and Activities
General Outcome Generalize arithmetic operations from the set of rational numbers to the set of polynomials. **Specific Outcome** 14. Find the quotient when a polynomial is divided by a monomial. [PS, R] (9–14)	14.1 Find the quotient. a) $\frac{6xy^2 + 12x^2y}{3xy}$ b) $\frac{16x^3 - 2x^2 + 6x}{-2x}$ 14.2 The area of a rectangle is $(6x^2 - 4x)$. Find the length of the rectangle if the width is $2x$.

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Strand: Patterns and Relations (Variables and Equations)

Students will:

- represent algebraic expressions in multiple ways.

C	Communication	**PS**	Problem Solving
CN	Connections	**R**	Reasoning
E	Estimation and Mental Mathematics	**T**	Technology
		V	Visualization

Outcomes	Illustrative Examples and Activities
General Outcome Solve and verify linear equations and inequalities using one variable. **Specific Outcome** 15. Illustrate the solution process for a one-step, single variable, first-degree equation, using concrete materials or diagrams. • $x + a = b$ • $x - a = b$ • $ax = b$ • $\frac{x}{a} = b$ [CN, PS, V] (7–7)	15.1 Use algebra tiles or diagrams to demonstrate the solution of the linear equation. a) $x + 3 = 5$ b) $s - 6 = 2$ c) $-2x = 8$

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Strand: Patterns and Relations (Variables and Equations)

Students will:

- represent algebraic expressions in multiple ways.

C	Communication	PS	Problem Solving
CN	Connections	R	Reasoning
E	Estimation and Mental Mathematics	T	Technology
		V	Visualization

Outcomes	Illustrative Examples and Activities
General Outcome Solve and verify linear equations and inequalities using one variable. **Specific Outcome** 16. Solve and verify one-step linear equations of the form: $x + a = b$ $\frac{x}{a} = b$ $ax = b$ where a, b and c are integers, using a variety of techniques. [PS, R] (7–8)	16.1 Solve and verify the following a) $x + 7 = -3$ b) $x - 11 = 15$ c) $4x = 10$ d) $\frac{x}{0.5} = -3.2$ 16.2 Jack solved the following equation, and found the answer to be $m = 2$. Show how to verify whether his answer is correct. $\frac{m}{5} = 10$

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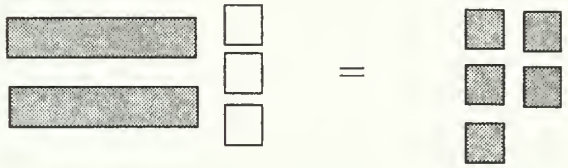
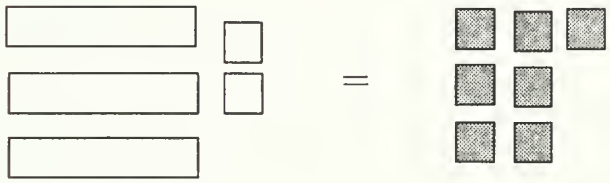
Strand: Patterns and Relations (Variables and Equations)

Students will:

- represent algebraic expressions in multiple ways.

C	Communication	**PS**	Problem Solving
CN	Connections	**R**	Reasoning
E	Estimation and Mental Mathematics	**T**	Technology
		V	Visualization

Outcomes	Illustrative Examples and Activities
General Outcome Solve and verify linear equations and inequalities using one variable. **Specific Outcome** 17. Illustrate the solution process for a two-step, single variable, first-degree equation, using concrete materials or diagrams. [CN, PS, V] (8–4)	17.1 Show how to manipulate the tiles to solve the equations represented by: a)  b) 

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Strand: Patterns and Relations (Variables and Equations)

Students will:

- represent algebraic expressions in multiple ways.

C	Communication	**PS**	Problem Solving
CN	Connections	**R**	Reasoning
E	Estimation and Mental Mathematics	**T**	Technology
		V	Visualization

Outcomes	Illustrative Examples and Activities
General Outcome Solve and verify linear equations and inequalities using one variable. **Specific Outcome** 18. Solve and verify one- and two-step first degree equations of the form: • $\frac{x}{a}+b=c$ • $ax+b=c$ where a, b, and c are integers. [PS, V] (8–5)	18.1 Solve and verify the following equations. a) $3x + 8 = 20$ b) $12 - 5x = -17$ c) $\frac{x}{-3}+7=14$ 18.2 Jackie solved the following equation and found it to be $x = -3$. Show how to verify whether her answer is correct. $-2x + 7 = 13$

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Strand: Patterns and Relations (Variables and Equations)

Students will:

- represent algebraic expressions in multiple ways.

C	Communication	**PS**	Problem Solving
CN	Connections	**R**	Reasoning
E	Estimation and Mental Mathematics	**T**	Technology
		V	Visualization

Outcomes	Illustrative Examples and Activities
General Outcome Solve and verify linear equations and inequalities using one variable. **Specific Outcome** 19. Solve and verify first-degree single-variable equations of the form: • $ax = b + cx$ • $a(x + b) = c$ • $ax + b = cx + d$ • $a(bx + c) = d(ex + f)$ • $\frac{a}{x} = b$ where a, b, c, d, e and f are rational numbers (with a focus on integers), and use equations of this type to model and solve problem situations. [C, PS, V] (9–5)	19.1 Solve and verify the following equations. a) $6x = 9 + 2x$ b) $-4x + 7 + 9x + 14$ c) $\frac{12}{x} = 3$ d) $3(x - 7) = -17.5$ e) $0.8(3n + 3) = 0.6(2n - 6)$ f) $\frac{5m}{6} - \frac{9}{2} = \frac{2m}{3}$ g) $\frac{2}{3}(x - 4) = \frac{5}{6}(x + 2)$ 19.2 The formula $G = 2.1h + 3.7$ can be used to find out how long a traffic light stays green. G is the green time in seconds and n is the average number of vehicles in each lane per light cycle. Determine the number of cars that can cross the intersection in one cycle, if the green time is 45 seconds. What should the green time be if the average number of cars per cycle is 42? *Reproduced with permission from British Columbia Ministry of Education.*

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Strand: Shape and Space (Measurement)
Students will:
- describe and compare everyday phenomena, using either direct or indirect measurement.

C	Communication	PS	Problem Solving
CN	Connections	R	Reasoning
E	Estimation and Mental Mathematics	T	Technology
		V	Visualization

Outcomes	Illustrative Examples and Activities
General Outcome Solve problems, using perimeter, area, surface area and volume. **Specific Outcome** 1. Estimate, measure and calculate the surface area and volume of any right prism, cylinder, cone or pyramid. [E, PS, T, R] (6–4, 7–2, 8–4)	1.1 You have been hired by a local movie theatre to design an open container with the following specifications: • a square, rectangular or circular base • will hold 4000 cm^3 of popcorn • will require the least amount of material to make. a) Determine the square, rectangular and circular containers that hold approximately 4000 cm^3 of popcorn and has the least surface area. Copy and complete a chart similar to the following for each shape. (Round, nearest hundredth)

Volume (cm^3)	Length (cm)	Width (cm)	Height (cm)	Surface Area (cm^2)
4000	10	10		

EXTENSION: From the consumer's point of view which is the better choice to make? Why?

b) What shape of container might be more efficient? Experiment with various values for radius, height etc. to determine the most efficient dimensions.

c) What factors other than minimum surface area might influence the size and shape of a container?

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Strand: Shape and Space (Measurement)

Students will:

- describe and compare everyday phenomena, using either direct or indirect measurement.

C	Communication	**PS**	Problem Solving
CN	Connections	**R**	Reasoning
E	Estimation and Mental Mathematics	**T**	Technology
		V	Visualization

Outcomes	Illustrative Examples and Activities
General Outcome Solve problems, using perimeter, area, surface area and volume. **Specific Outcome** 2. Demonstrate concretely, pictorially and symbolically that many rectangles are possible for a given perimeter or a given area. [CN, R] (6–7)	2.1 a) A rectangle has a perimeter of 40. i) What are the dimensions of the rectangle with the largest area? The smallest area? ii) If you double the dimensions of the rectangle, what happens to the areas of the largest and smallest rectangles? b) Compare the area of a circle to its circumference. If the diameter of the circle doubles (triples, halves), investigate what happens to its circumference and area. c) In the following pattern, the length of 1 side of a small square is 1 unit. Complete the table. Figure 1 Figure 2 Figure 3 Figure 4 i) What is the ratio of the perimeter to the area of the ninth figure? ii) What happens to the ratio of the perimeter to the area as the number of squares increases? iii) Find the algebraic expressions of perimeter, area, and the ratio of perimeter to area for the n^{th} figure.

Figure	No. of Squares (N)	Perimeter (P)	Area (A)	Ratio $\frac{P}{A}$
1				
2				
3				
4				

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Strand: Shape and Space (Measurement)

Students will:

- describe and compare everyday phenomena, using either direct or indirect measurement.

C	Communication	**PS**	Problem Solving
CN	Connections	**R**	Reasoning
E	Estimation and Mental Mathematics	**T**	Technology
		V	Visualization

Outcomes	Illustrative Examples and Activities

d) Given a series of isosceles triangles with equal sides of 10 cm and different base angles, complete the chart:

Length of Equal Sides (cm)	Base Angle (°)	Area (A) (cm^2)	Perimeter (P) (cm)	Ratio $\frac{P}{A}$
10				
10				
10				
10				
10				

i) Is there a pattern with the areas? Perimeters? Ratios? Explain.

ii) Which triangle yields the maximum area?

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2.2 A square, other rectangles, and a circle each have a perimeter of 50 cm.

a) Find the dimensions of the square, at least 2 other rectangles, and the circle.

b) Find the area of each and state which shape has the largest area.

2.3 A square, other rectangles, and a circle each have an area of 600 m^2.

a) Find the dimensions of the square, at least 2 other rectangles, and the circle.

b) Find the perimeter of each and state which shape has the largest perimeter.

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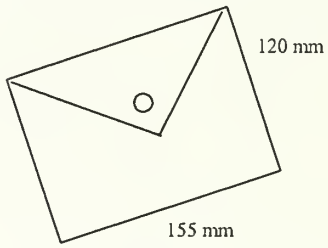
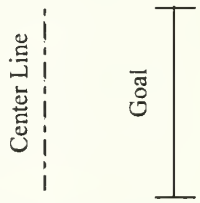
Strand: Shape and Space (Measurement)
Students will:
- describe and compare everyday phenomena, using either direct or indirect measurement.

C	Communication	**PS**	Problem Solving
CN	Connections	**R**	Reasoning
E	Estimation and Mental Mathematics	**T**	Technology
		V	Visualization

Outcomes	Illustrative Examples and Activities
General Outcome Solve problems, using right angle triangles. **Specific Outcome** 3. Use the Pythagorean relationship to calculate the measure of the third side, of a right triangle, given the other two sides in 2-D applications. [PS] (8–2)	3.1 Passengers on airplanes sometimes get bored, so an airline gives them a small, thin wallet at the start of a trip. The wallet has square corners and measures 120 mm by 155 mm. Inside is a crossword puzzle and a pencil. The pencil is 190 mm long. Use calculations to show that the pencil will fit in the wallet.  3.2 New surveyor methods measure distances only. If you were standing somewhere on the center line of a soccer field and wanted to find the width of the soccer goal, where would you stand? What measurements would you need to take? How would you use these to calculate the width of the goal?  *Reproduced with permission from Saskatchewan Ministry of Education.*

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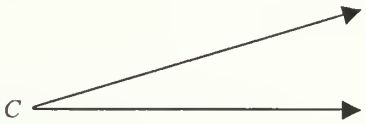
Strand: Shape and Space (Measurement)
Students will:
- describe and compare everyday phenomena, using either direct or indirect measurement.

C	Communication	**PS**	Problem Solving
CN	Connections	**R**	Reasoning
E	Estimation and Mental Mathematics	**T**	Technology
		V	Visualization

Outcomes	Illustrative Examples and Activities
General Outcome Solve problems, using right angle triangles. **Specific Outcome** 4. Estimate measure and classify angles as: • acute • obtuse • right • straight • reflex. [E] (6–10)	4.1 Without using a protractor, draw an acute angle and an obtuse angle and estimate the measure of each. Use a protractor to check your angles. 4.1 Using a protractor, draw an angle of 210° and one of 115°. 4.3 Use a protractor and a ruler to draw an angle that is the same measure as angle *C*. 

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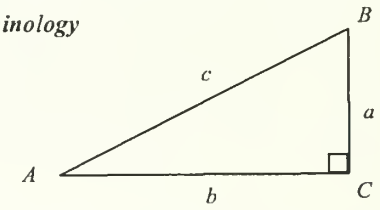
Strand: Shape and Space (Measurement)

Students will:

- describe and compare everyday phenomena, using either direct or indirect measurement.

C	Communication	**PS**	Problem Solving
CN	Connections	**R**	Reasoning
E	Estimation and Mental Mathematics	**T**	Technology
		V	Visualization

Outcomes	Illustrative Examples and Activities
General Outcome Solve problems, using right angle triangles. **Specific Outcome** 5. Explain the meaning of sine, cosine and tangent ratios in right triangles. [C, R] (9–1)	5.1 Reinforce the concept that trigonometric ratios are the ratios of the lengths of sides of right triangles. ***Terminology***  $\text{sine of an angle} = \frac{\textit{side opposite the angle}}{\textit{hypotenuse}}$ $\sin A = \frac{a}{c}$ $\quad\quad$ $\sin B = \frac{b}{c}$ $\text{cosine of an angle} = \frac{\textit{side adjacent to the angle}}{\textit{hypotenuse}}$ $\cos A = \frac{b}{c}$ $\quad\quad$ $\cos B = \frac{a}{c}$ $\text{tangent of an angle} = \frac{\textit{side opposite the angle}}{\textit{side adjacent to the angle}}$ $\tan A = \frac{a}{b}$ $\quad\quad$ $\tan B = \frac{b}{a}$

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Strand: Shape and Space (Measurement)

Students will:

- describe and compare everyday phenomena, using either direct or indirect measurement.

C	Communication	PS	Problem Solving
CN	Connections	R	Reasoning
E	Estimation and Mental Mathematics	T	Technology
		V	Visualization

Outcomes	Illustrative Examples and Activities

5.2 a) Draw accurate right triangles in which on of the angles is 10°. (Repeat for triangles with one of the angles 20°, 30°, 40°, …,80°.)

i) For each of the triangles, measure the length of the adjacent side for the specified angle and the hypotenuse.

ii) Find the cosine of the angle using the measured lengths.

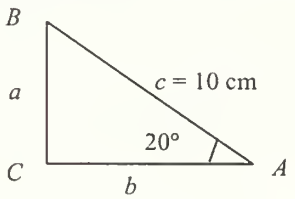
iii) Complete the table.

Triangle	Angle	Length of Adjacent (a)	Length of Hypotenuse (h)	Ratio a/h	Calculator Value of cosine
1	10°				
2	20°				
3	30°				

Graph your results.

iv) Compare results with other students. State your conclusions.

5.3 In the triangle, if you wanted the length of a, which ratio would you use? Could you use another ratio? What is the length of b?



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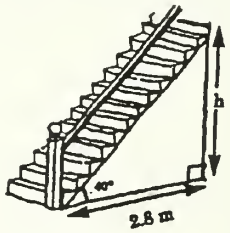
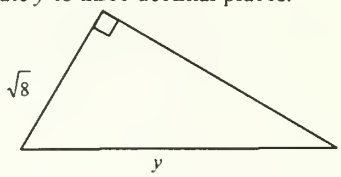
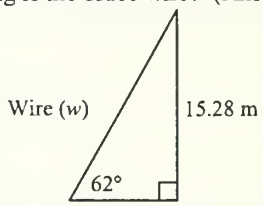
Strand: Shape and Space (Measurement)
Students will:
- describe and compare everyday phenomena, using either direct or indirect measurement.

C	Communication	**PS**	Problem Solving
CN	Connections	**R**	Reasoning
E	Estimation and Mental Mathematics	**T**	Technology
		V	Visualization

Outcomes	Illustrative Examples and Activities
General Outcome Solve problems, using right angle triangles. **Specific Outcome** 6. Calculate an unknown side or an unknown angle in a right triangle, using trigonometric ratios. [PS, T, V] (9–3)	6. a) Find the height of the staircase (side h). Round your answer to 1 decimal place.  b) Calculate y to three decimal places.  6.2 A pole is 15.28 m high. A brace wire makes an angle of 62° with the ground. How long is the brace wire? (Answer to 2 decimal places.)  6.3 Triangle ABC has angles of 45° –45° –90°. What are the possible lengths of the sides? Show at least 2 examples. *Reproduced with permission from Manitoba Education and Training.*

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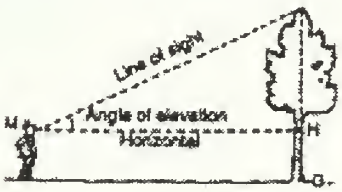
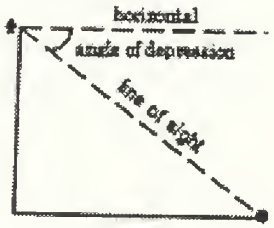
Strand: Shape and Space (Measurement)
Students will:
- describe and compare everyday phenomena, using either direct or indirect measurement.

C	Communication	PS	Problem Solving
CN	Connections	R	Reasoning
E	Estimation and Mental Mathematics	T	Technology
		V	Visualization

Outcomes	Illustrative Examples and Activities
General Outcome Solve problems, using right angle triangles. **Specific Outcome** 7. Model and then solve given problem situations involving only one right triangle. (PS, T, V] (9–4)	7.1 ***Terminology*** *Angle of elevation*—If you stand and look directly at the top of a tall tree, your line of sight slopes upwards from the horizontal. The angle between your line of sight and the horizontal is called the *angle of elevation* to the top of the tree from where you are standing.  *Angle of depression*—If you stand on a cliff and look down toward an object, the angle between the horizontal and the line of sight is called the *angle of depression.*  Surveyors measure angles of elevation with an instrument called a *theodolite*. On a more basic level, a *clinometer* can be used by students to find the height of tall structures. *Used with permission from Manitoba Education and Training.*

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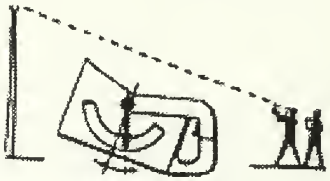
Strand: Shape and Space (Measurement)

Students will:

- describe and compare everyday phenomena, using either direct or indirect measurement.

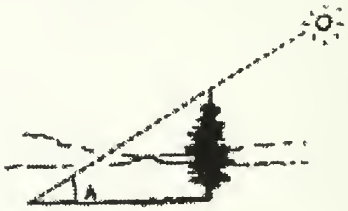
C	Communication	PS	Problem Solving
CN	Connections	R	Reasoning
E	Estimation and Mental Mathematics	T	Technology
		V	Visualization

Outcomes	Illustrative Examples and Activities
	Clinometers can be purchased (like the one shown in the diagram) or can be constructed from a protractor, a straw, string, and a plumb line.



7.1 *Examples*

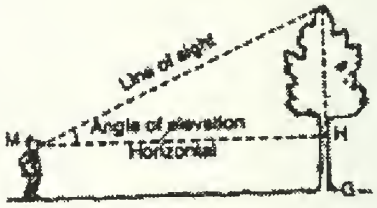
a) A tree 2.50 m tall casts a shadow 4.36 m long. Calculate the angle of elevation of the sun to the nearest degree. (The angle is marked A in the diagram.)



b) Suppose that the distance *MH* in the picture is 10 m, and the angle of elevation is 25°.

i) Calculate the distance *TH* , to the nearest 0.1 m.

ii) To find the height of the tree, you have to add the distance *HG*. This is the same as the height of the man's eyes above the ground. If his eyes are 1.6 m above the ground, how high is the tree:



iii) The same man stands 25 m away from a flagpole and finds that the angle of elevation of the top of the pole is 41°. How tall is the pole?

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Strand: Shape and Space (Measurement)

Students will:

- describe and compare everyday phenomena, using either direct or indirect measurement.

C	Communication	**PS**	Problem Solving
CN	Connections	**R**	Reasoning
E	Estimation and Mental Mathematics	**T**	Technology
		V	Visualization

Outcomes	Illustrative Examples and Activities
	7.2 Find the height of a tall structure close to the school using a clinometer and a measuring tape. a) Make a scale drawing to find the height. b) Use trigonometric ratios to find the height. Compare your answers and write a detailed report on your procedures and findings. There is another way to complete this task. What is it? Explain. *Reproduced with permission from Manitoba Education and Training.*

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Strand: Shape and Space (3-D Objects and 2-D Shapes)

Students will:

- describe the characteristics of 3-D objects and 2-D shapes, and analyze the relationships among them.

C	Communication	**PS**	Problem Solving
CN	Connections	**R**	Reasoning
E	Estimation and Mental Mathematics	**T**	Technology
		V	Visualization

Outcomes	Illustrative Examples and Activities
General Outcome Specify conditions under which triangles may be similar and use these conditions to solve problems. **Specific Outcome** 8. Recognize when, and explain why, two triangles are similar, and use the properties of similar triangles to solve problems. [C, PS, R, T] (9–8)	8.1 *Examples* a) Which of the following are always true for similar triangles? i) They have the same shape. ii) They are the same size. iii) They have the same orientation. iv) Their corresponding angles are equal. v) Their corresponding sides are equal. b) Shandra said that 2 triangles drawn on a page "looked" similar. How can she find out for sure if they are or are not similar? Find 2 different ways she can do this, and explain your reasoning. c) Given 1 triangle, magnify two of the sides by a factor of 2. Explore the relationships between the angles and sides of the original triangle and the enlarged triangle. d) In pairs, have students measure the height vs. length of shadows for 2 or 3 objects. These measurements must be done at the same time of day. Data are then collected from the whole class. Students construct a scatterplot from this data and interpret the graph.

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Strand: Shape and Space (3-D Objects and 2-D Shapes)

Students will:

- describe the characteristics of 3-D objects and 2-D shapes, and analyze the relationships among them.

C	Communication	**PS**	Problem Solving
CN	Connections	**R**	Reasoning
E	Estimation and Mental Mathematics	**T**	Technology
		V	Visualization

Outcomes	Illustrative Examples and Activities

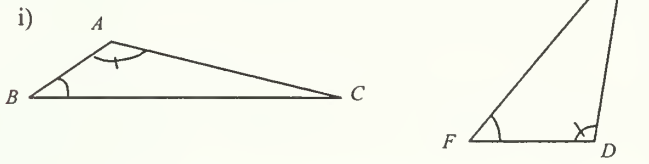
It is recommended that students investigate to find necessary and sufficient conditions for similarity. Have students use the following statements to summarize their findings on similar triangles.

a) If 2 triangles are similar, then corresponding angles are congruent and corresponding sides are proportional.

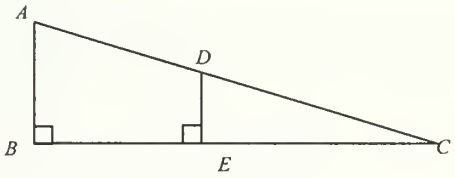
b) If corresponding angles are congruent, then the 2 triangles are similar and corresponding sides are proportional.

e) For each of the following pairs of similar triangles, write the ratio of sides that are equivalent to $\frac{AC}{BC}$.

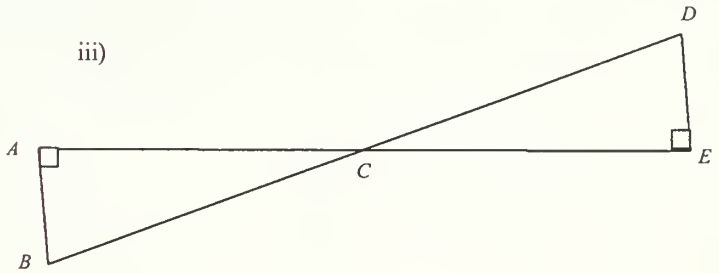
i)



ii)



iii)



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Strand: Shape and Space (3-D Objects and 2-D Shapes)

Students will:

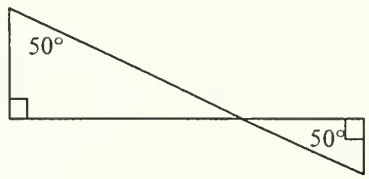
- describe the characteristics of 3-D objects and 2-D shapes, and analyze the relationships among them.

C	Communication	**PS**	Problem Solving
CN	Connections	**R**	Reasoning
E	Estimation and Mental Mathematics	**T**	Technology
		V	Visualization

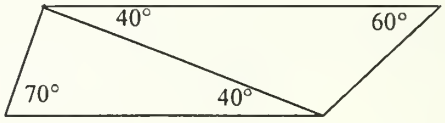
Outcomes	Illustrative Examples and Activities

f) Which of the following pairs of triangles are similar? Explain why.

i)



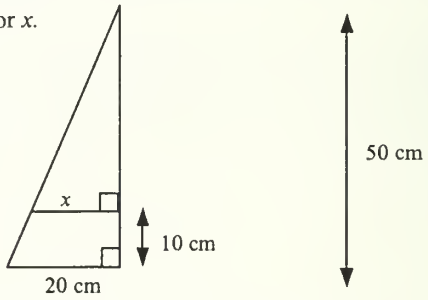
ii)



8.2 Sol made a scale drawing of his triangular vegetable garden, so he could plan how to plant it. Two sides of the garden are 10 m and 12 m and they form an angle of 50°. He drew a 50°.angle on paper and made a triangle by marking points 20 cm and 24 cm on the sides of the angle and connecting them. He measured the third side to be 19 cm. What scale did he use? What is the length of the third side of the actual garden?

8.3 a) A building is 90 m high. What scale factor would you use to draw a diagram in which the building has a height of 15 cm?

b) Solve for x.



c) The length of a shadow of a monument is 26 m when the length of Sonia's shadow is 7.8 m. If Sonia is 1.5 m tall, calculate the height of the monument.

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Strand: Shape and Space (Transformations)
Students will:
- perform, analyze and create transformations.

C	Communication	**PS**	Problem Solving
CN	Connections	**R**	Reasoning
E	Estimation and Mental Mathematics	**T**	Technology
		V	Visualization

Outcomes	Illustrative Examples and Activities
General Outcome Create and analyze patterns and design, using symmetry, translation, rotation and reflection. **Specific Outcome** 9. Draw designs, using ordered pairs, in all four quadrants of the co-ordinate grid. [PS, V] (7–13)	9.1 What is located at each of these points? A) (5.2) B) (3,8) C) (–2,4) 9.2 Name the coordinates at each of these locations: A) Himax Theatre B) Library C) Mall D) Dance Academy 9.3 What is the same about the coordinates of the points in each of the quadrants? 9.4 Use the appropriate sign and the coordinates (x, y), write an ordered pair for each of the four quadrants. 9.5 What is similar about all points on the x-axis? 9.6 What is similar about all points on the y-axis? 9.7 Plot the location of your house with the ordered pairs (–3,–5).

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Strand: Shape and Space (Transformations)
Students will:
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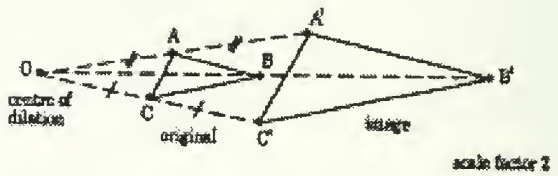
C	Communication	PS	Problem Solving
CN	Connections	R	Reasoning
E	Estimation and Mental Mathematics	T	Technology
		V	Visualization

Outcomes	Illustrative Examples and Activities
General Outcome Create and analyze patterns and design, using symmetry, translation, rotation and reflection. **Specific Outcome** 10. Draw and interpret scale diagrams: • enlargements • reductions. [PS,T] (8–11)	*Terminology* *Dilatation* or *dilation*—a transformation of a figure or object such that the image has a similar shape to the original (it may be larger, smaller, or the same size) To *enlarge* ΔABC by a factor of 2 (such that the sides are twice as long in the image $\Delta A'B'C'$). 10.1 Select a point from which you will create your dilatation (this point is called the center of dilatation)  10.2 Join from the centre of dilatation to each vertex of the figure to be dilated. For example, join the centre of dilatation O to vertex A. 10.3 Measure the distances from the centre of dilatation to each vertex. 10.4 Multiply each of those distances by the scale factor. 10.5 Draw the new distances by extending the lines from O through the vertices, so that each line is 2 times its original length.

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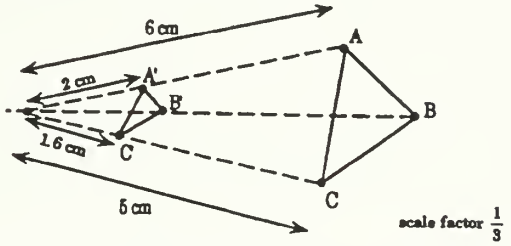
		V	Visualization

Outcomes	Illustrative Examples and Activities

When reducing, place a point on the line that connects the centre of dilatation and the vertex according to the scale factor.



Mapping notation for dilatations is $(x, y) \rightarrow (3x, 3y)$. This indicates that the scale factor is 3.

Have students discuss and write about a figure and its dilatation image. For example, after a dilatation with scale factor 3, the measures of the angles of a figure and its image are equal. The lengths of the sides of the image are 3 times the lengths of the corresponding sides of the original figure. Therefore, the figures are similar.

10.6

a) Plot ΔXYZ with vertices $X(-2, -1)$, $Y(-1, 2)$, $Z(0, -1)$.

i) Multiply each coordinate by 3 (dilatation factor) and draw the image.

$X'(-6, -3)$, $Y'(-3, 6)$, $Z'(0, -3)$

ii) Measure all sides of both triangles. Using ratios, compare the sides.
$YZ : Y'Z'$, $XY : X'Y'$, $XZ : X'Z'$.
How do the ratios compare?

iii) Measure all angles of both triangles. What do you notice?

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Strand: Shape and Space (Transformations)

Students will:

- perform, analyze and create transformations.

C	Communication	**PS**	Problem Solving
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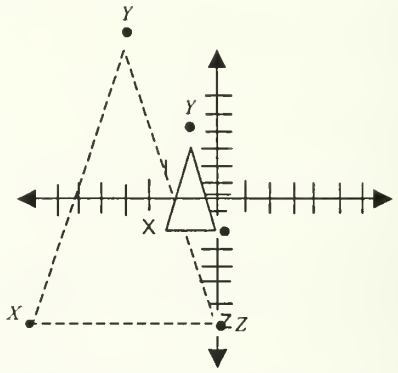
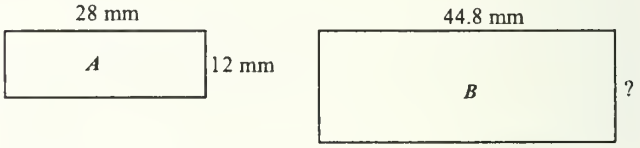
E	Estimation and Mental Mathematics	**T**	Technology
		V	Visualization

Outcomes	Illustrative Examples and Activities

iv) Calculate the area of both triangles. Is there a relationship?



b) If rectangle *A* is enlarged to fill exactly rectangle *B*, what must be the dilatation factor? What is the width of rectangle *B*? What relationship exists between the areas of rectangle *A* and *B*?



- Reduce a figure by multiplying the *x* and *y* coordinates by the same fraction (between 0 and 1).

  a) Plot the figure and its image.
  b) Notice differences in side lengths and areas.
  c) Notice that shape and angles are the same.
  d) Identify the dilatation factor.

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Strand: Shape and Space (Transformations)
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C	Communication	**PS**	Problem Solving
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		V	Visualization

Outcomes	Illustrative Examples and Activities
	10.7 a) Plot ΔDEF, $D(2,-2)$, $E(-2,4)$, $F(10,8)$ and its image if the dilatation factor is $\frac{1}{2}$. Compare the lengths of corresponding sides, the measure of corresponding angles, and the areas. b) Rectangle C has been reduced by a factor of 0.4 to produce rectangle D. What is the length of rectangle D? What is the width of rectangle C? What relationship exists between the areas? 16 cm C D 4 cm c) Draw ΔPEA with $P(0,6)$, $E(-3,-3)$, and $A(3,-6)$. Using the origin (0, 0) as the dilatation centre and a scale factor of $\frac{1}{3}$, draw the reduction image.

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Strand: Statistics and Probability (Data Analysis)

Students will:

- collect, display and analyze data to make predictions about a population.

C	Communication	PS	Problem Solving
CN	Connections	R	Reasoning
E	Estimation and Mental Mathematics	T	Technology
		V	Visualization

Outcomes	Illustrative Examples and Activities
General Outcome Develop and implement a plan for the display and analysis of data. **Specific Outcome** 1. Read and interpret graphs that are provided. [C, E, PS, R] (6–7)	1.1 What are some conclusions you can make from this graph? Explain your reasoning for each. What important information is not provided by this graph? Could this graph be true for the students in your class? Your school? Why? *Reproduced with permission from Saskatchewan Education. (Pending)* 1.2 Find some graphs in your local newspaper. Working in a group, discuss the following questions. a) Does the data give the information indicated? b) Is the type of graph appropriate for the data? c) Have scales, pictures, or data groupings been selected to distort data? d) Does the graph present data clearly? Is it visually appealing? 1.3 Collect data on the population of your school over the last 10 years. Graph the information. What would you predict the school population will be in six years? What trends do you see in the population? Can you suggest any reasons for these trends? Would enrolment figures suggest a need to increase the size of your school facility in the next ten years? Why or why not?

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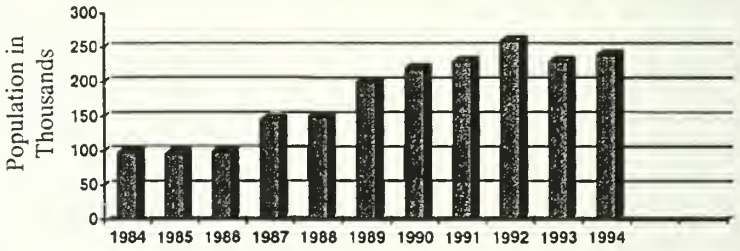
Strand: Statistics and Probability (Data Analysis)

Students will:

- collect, display and analyze data to make predictions about a population.

C	Communication	PS	Problem Solving
CN	Connections	R	Reasoning
E	Estimation and Mental Mathematics	T	Technology
		V	Visualization

Outcomes	Illustrative Examples and Activities
	1.4 Encourage students to analyze and interpret graphs they have done themselves as well as those found in other sources. One suggestion here might be to give students a sample graph from the newspaper or some other source and ask them to describe, orally or in writing, events that could fit the graph. One such graph is given below.  *Reproduced with permission from Saskatchewan Education. (Pending)*

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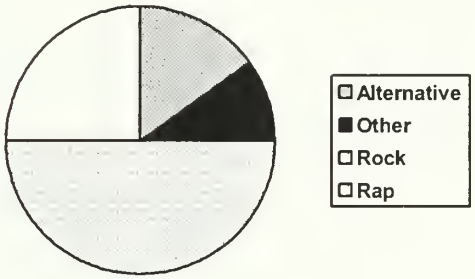
Strand: Statistics and Probability (Data Analysis)

Students will:

- collect, display and analyze data to make predictions about a population.

C	Communication	**PS**	Problem Solving
CN	Connections	**R**	Reasoning
E	Estimation and Mental Mathematics	**T**	Technology
		V	Visualization

Outcomes	Illustrative Examples and Activities
	1.5 The graph below shows the results of a survey of 60 students. What do you think the survey is about? About how many students are in each category?  1.6 Although graphs are effective for communicating information quickly, students require skills for reading and interpreting them accurately. One approach for determining whether students understand a graph is to give them 3 or 4 graphs and ask them to select the one that best represents a situation. Students should then discuss why one graph is better than another. 1.7 Discuss with students the necessary care with which inferences and decisions must be made. Provide experiences that lead to results that may not be readily anticipated and that might be surprises. Intuition is a powerful tool but cannot be relied on exclusively.

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Strand: Statistics and Probability (Data Analysis)

Students will:

- collect, display and analyze data to make predictions about a population.

C	Communication	**PS**	Problem Solving
CN	Connections	**R**	Reasoning
E	Estimation and Mental Mathematics	**T**	Technology
		V	Visualization

Outcomes	Illustrative Examples and Activities
General Outcome Analyze experimental results expressed in two variables. **Specific Outcome** 2. Create scatterplots for discrete and continuous variables. [C, V] (9–2)	***Terminology*** *Scatterplot*—a graph with points plotted on a coordinate grid that attempts to show a relationship between 2 variables. When applicable, place the independent variable along the x-axis and the dependent variable along the y-axis. When creating a table of bivariate data, the independent variable is presented in the top *Reproduced with permission from Manitoba Education and Training.* ***Example*** 2.1 Prepare a scatterplot for the data shown below. **Jump Shots Made in 25 Attempts** *Reproduced with permission from Manitoba Education and Training.*

Distance From Basket (m)	8	5	3	6	5	2	3	4	4
Jump Shots Made	6	10	15	7	9	18	20	10	15

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Strand: Statistics and Probability (Data Analysis)

Students will:

- collect, display and analyze data to make predictions about a population.

C	Communication	**PS**	Problem Solving
CN	Connections	**R**	Reasoning
E	Estimation and Mental Mathematics	**T**	Technology
		V	Visualization

Outcomes	Illustrative Examples and Activities
	2.2 From a data base of countries in the world, select any 2 of the following variables to compare in a scatterplot. Variables • life expectancy • number of doctors • population • infant mortality • accidental death *Reproduced with permission from Manitoba Education and Training.* 2.3 Compare the populations to the areas of Canadian provinces in a scatterplot. Is there a correlation? *Reproduced with permission from Manitoba Education and Training.*

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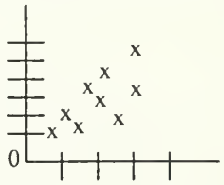
Strand: Statistics and Probability (Data Analysis)

Students will:

- collect, display and analyze data to make predictions about a population.

C	Communication	**PS**	Problem Solving
CN	Connections	**R**	Reasoning
E	Estimation and Mental Mathematics	**T**	Technology
		V	Visualization

Outcomes	Illustrative Examples and Activities
General Outcome Analyze experimental results expressed in two variables. **Specific Outcome** 3. Interpret a scatterplot to determine if there is an apparent relationship. [E, R] (9–3)	3.1 a) Consider the following scatterplot.  This scatterplot is missing many important details: i) What are possible titles and scales for the axes? ii) Describe the information displayed by the data points. Provide more than 1 answer for (i) and (ii). a) Predict whether or not there is a relationship between the height of a person and the height of his or her father. i) Would this scatterplot be different if the height of the mother was used instead? ii) Write an explanation as to why this is true or untrue in your personal situation.

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Strand: Statistics and Probability (Data Analysis)

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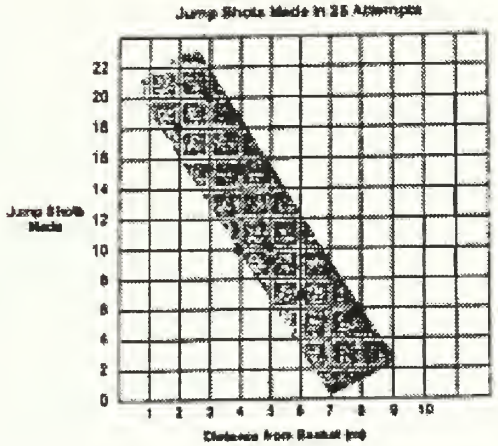
C	Communication	PS	Problem Solving
CN	Connections	R	Reasoning
E	Estimation and Mental Mathematics	T	Technology
		V	Visualization

Outcomes	Illustrative Examples and Activities
	Example 3.2 For the data shown below, determine whether or not a correlation exists and state if it is a positive or negative correlation.  *Reproduced with permission from Manitoba Education and Training.*

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Strand: Statistics and Probability (Data Analysis)
Students will:
- collect, display and analyze data to make predictions about a population.

C	Communication	PS	Problem Solving
CN	Connections	R	Reasoning
E	Estimation and Mental Mathematics	T	Technology
		V	Visualization

Outcomes	Illustrative Examples and Activities
General Outcome Analyze experimental results expressed in two variables. **Specific Outcome** 4. Determine the line of best fit from a scatterplot for an apparent linear relationship by inspection. [E, PS] (9–4)	*Terminology* *Line of Best Fit*—the line that best illustrates the relationship between the variables Have students use inspection to draw lines of best fit (indicate that no calculation is required). A clear or transparent ruler works best for drawing a line of best fit by inspection. 4.1 ***Example*** Plot the data below and draw a line of best fit. **BMX Dirt-Bike Jumping** See table below.

Mass (kg)	Jump Height (cm)	Mass (kg)	Jump Height (cm)
41.8	26.3	48.4	25.0
42.9	26.2	49.5	24.9
44.0	26.0	50.6	24.9
45.1	25.9	51.7	24.6
46.2	25.7	52.8	24.4

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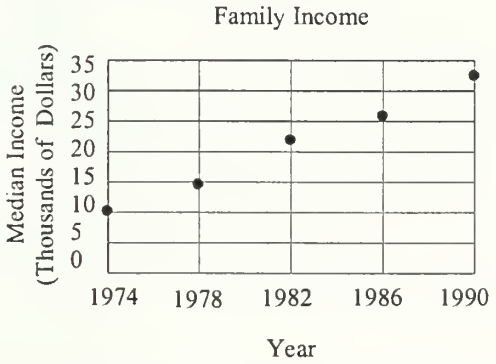
Outcomes	Illustrative Examples and Activities
General Outcome Analyze experimental results expressed in two variables. **Specific Outcome** 5. Draw and justify conclusions from the line of best fit by: • interpolation • extrapolation. [C, R] (9–5)	***Terminology*** *Interpolate*—to estimate (or calculate) a value between 2 values that are already known *Extrapolate*—to estimate (or calculate) value by using the established pattern and going beyond known values ***Example*** Use the graph shown below to do the following: a) Estimate the median family income for the year 1988.  b) Predict the median family income for the year 1998. What factors do you think might affect the median income of the future?

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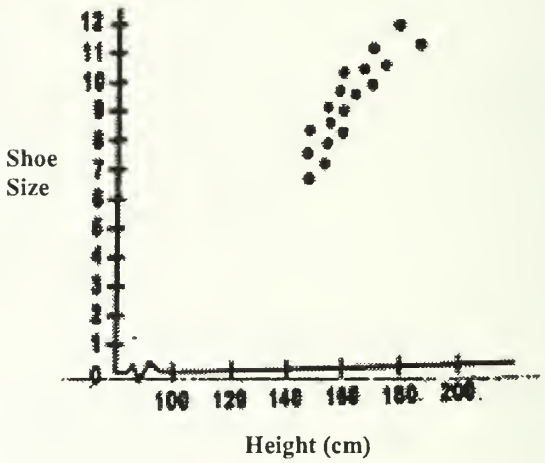
Outcomes	Illustrative Examples and Activities
	c) Explain whether the answer in (i) or (ii) represents extrapolation. i) Draw the line of best fit and state the conclusions that can be drawn from this data. ii) How would you improve this scatterplot?  d) Refer to the scatterplot titled "BM Dirt-Bike Jumping" (Outcome No. 4) and use the line of best fit to predict. i) the height of a jump for a bike with a mass of 47 kg (interpolation) ii) the mass of a bike that would jump a height of 26.8 cm (extrapolation)

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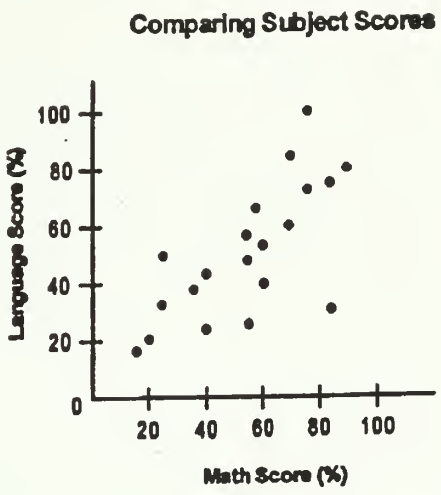
		V	Visualization

Outcomes	Illustrative Examples and Activities
	e) Refer to the scatterplot shown below.



i) What correlation between math scores and language scores is shown?

ii) If a student were to receive a math score of 50%, predict his or her language score.

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